

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (original) A gasifier comprising:
spaced coarse and fine fuel inlet ports;
a fixed bed gasification section where coarse fuel is gasified;
an entrained flow gasification section where fine fuel is gasified; and
a gas effluent port where gases generated from coarse fuel and fine fuel are collectively discharged.
2. (original) The gasifier according to claim 1, wherein the fixed bed gasification section comprises:
an upper fixed bed section that receives coarse fuel from the coarse fuel inlet in which the coarse fuel is devolatilized to form volatilized gases which flow downward;
and
a lower fixed bed section.
3. (original) The gasifier according to claim 2, further comprising:
an internal cross-section constriction in the upper fixed bed section; and
an upper plenum disposed adjacent said constricted cross-section.
4. (original) The gasifier according to claim 3, wherein effluent gas from the fixed bed gasification section and the entrained flow gasification section collect within the upper plenum and wherein the gas effluent site is located adjacent the upper plenum.

5. (original) The gasifier according to claim 4, wherein the upper plenum is configured to provide an effluent gas residence time and operating temperature sufficient to crack tars and oils contained within the effluent gas.

6. (currently amended) The gasifier according to claim 2, wherein the upper fixed bed section is configured to operate at a temperature which converts a portion of the coarse fuel into activated carbon char.

7. (currently amended) The gasifier according to claim 6, wherein activated carbon char is entrained with the effluent gas.

8. (currently amended) The gasifier according to claim 7, further comprising an activated carbon char collector to capture and remove activated carbon char entrained in the effluent gas.

9. (currently amended) The gasifier according to claim 6, further comprising an activated carbon char removal port to permit removal of activated carbon char from the fixed bed gasification section.

10. (currently amended) The gasifier according to claim 9, further comprising a screw device in combination with the activated carbon char removal port to permit removal of activated carbon char.

11. (original) The gasifier according to claim 1, wherein the entrained flow gasification section disposed in a lower plenum adjacent the lower fixed bed section which volatilizes fine fuel.

12. (original) The gasifier according to claim 1, wherein fine fuel is fed into the entrained flow gasification section by at least one tangentially fired burner.

13. (original) The gasifier according to claim 12, wherein the fine fuel is selected from pulverized solid fuel, liquid fuel, gaseous fuel, and combinations thereof.

14. (currently amended) The gasifier according to claim 1, wherein a portion of the fine fuel is sized to ensure incomplete carbon combustion of the fine fuel which results in the generation of activated carbon char particles entrained with the effluent gas.

15. (currently amended) The gasifier according to claim 14, further comprising an activated carbon char collector to capture and remove activated carbon char entrained in the effluent gas.

16. (currently amended) The gasifier according to claim 1, which generates activated carbon char entrained in the effluent gas, further comprising an activated carbon char collector to capture and remove activated carbon char from the effluent gas, further comprising pollution control equipment which contacts the effluent gas with said activated carbon char to capture and remove pollutants from the effluent gas.

17. (original) The gasifier according to claim 16, wherein the pollutants are selected from sulfur compounds, halogen compounds, and heavy metals.

18. (original) The gasifier according to claim 1, further comprising a plurality of injection ports configured to introduce oxygen, steam, or air into different regions of the gasifier.

19. (original) The gasifier according to claim 18, wherein the injection ports are configured to facilitate temperature control within the gasifier.

20. (original) The gasifier according to claim 18, wherein the injection ports are configured to control the steam to oxygen ratio within the gasifier.

21. (original) The gasifier according to claim 18, wherein the injection ports are configured to control the hydrogen to carbon monoxide ratio within the gasifier.

22. (original) The gasifier according to claim 18, wherein the injection ports are configured to control the amount of oxygen, steam, or air in different sections of the gasifier to promote a partial water gas shift reaction.

23. (original) The gasifier according to claim 22, wherein the injection ports are configured to control the amount of oxygen, steam, or air in different sections of the gasifier to control the temperature and to promote a methanation reaction.

24. (original) The gasifier according to claim 1, configured to simultaneously process coarse fuel in the fixed bed gasification section and fine fuel in the entrained flow gasification section.

25. (original) The gasifier according to claim 1, wherein the fine fuel is selected from pulverized solid fuel, liquid fuel, gaseous fuel, and combinations thereof.

26. (original) The gasifier according to claim 1, further comprising a plurality of pulsating jets disposed about the lower fixed bed section which agitate coarse fuel or ash within the fixed bed section.

27. (original) The gasifier according to claim 26, wherein the pulsating jets inject pressurized gas pulses.

28. (original) The gasifier according to claim 27, wherein the gas pulses comprise pulses of air, oxygen, steam, carbon dioxide, gaseous fuel, or recycled effluent gas.

29. (original) The gasifier according to claim 1, configured to operate using only coarse fuel in the fixed bed gasification section.

30. (original) A gasifier having a two-stage fixed bed gasification section and an entrained flow gasification section comprising:

- a coarse fuel inlet;

- a two-stage fixed bed gasification section that receives coarse fuel from the coarse fuel inlet, said fixed bed gasification section comprising:

- an upper fixed bed section in which the coarse fuel is devolatilized to form volatilized gases which flow downward;

- an internal cross-section constriction in the upper fixed bed section;

- a lower fixed bed section; and

- an upper plenum disposed adjacent the internal cross-section constriction;

- an entrained flow gasification section disposed in a lower plenum adjacent the lower fixed bed section which volatilizes fine fuel, wherein fine fuel is fed into the entrained flow gasification section by at least one tangentially fired burner;

- a plurality of injection ports configured to introduce oxygen, steam, or air into different sections of the gasifier;

- a plurality of pulsating jets disposed about the lower fixed bed section which agitate coarse fuel or ash within the fixed bed section; and

- a gas effluent site from which gases obtained from the coarse and fine fuels are collectively discharged, wherein effluent gas from the fixed bed gasification section and the entrained flow gasification section collect within the upper plenum and wherein the gas effluent site is located adjacent the upper plenum.

31. (original) The gasifier according to claim 30, wherein the fine fuel is selected from pulverized solid fuel, liquid fuel, gaseous fuel, and combinations thereof.

32. (original) The gasifier according to claim 30, wherein the injection ports are configured to facilitate temperature control within the gasifier.

33. (original) The gasifier according to claim 30, wherein the injection ports are configured to control the steam to oxygen ratio within the gasifier.

34. (original) The gasifier according to claim 30, wherein the injection ports are configured to control the hydrogen to carbon monoxide ratio within the gasifier.

35. (original) The gasifier according to claim 30, wherein the injection ports are configured to control the amount of oxygen, steam, or air in different sections of the gasifier to promote a partial water gas shift reaction.

36. (original) The gasifier according to claim 35, wherein the injection ports are configured to control the amount of oxygen, steam, or air in different sections of the gasifier to control the temperature and to promote a methanation reaction.

37. (currently amended) The gasifier according to claim 30, wherein the upper fixed bed section is configured to operate at a temperature which converts a portion of the coarse fuel into activated carbon char.

38. (currently amended) The gasifier according to claim 37, wherein activated carbon char is entrained with the effluent gas.

39. (currently amended) The gasifier according to claim 38, further comprising an activated carbon char collector to capture and remove activated carbon char entrained in the effluent gas.

40. (currently amended) The gasifier according to claim 37, further comprising an activated carbon char removal port to permit removal of activated carbon char from the fixed bed gasification section.

41. (currently amended) The gasifier according to claim 40, further comprising a screw device in combination with the activated carbon char removal port to permit removal of activated carbon char.

42. (currently amended) The gasifier according to claim 30, wherein a portion of the fine fuel is sized to ensure incomplete carbon combustion of the fine fuel which results in the generation of activated carbon char particles entrained with the effluent gas.

43. (currently amended) The gasifier according to claim 42, further comprising an activated carbon char collector to capture and remove activated carbon char entrained in the effluent gas.

44. (currently amended) The gasifier according to claim 30, which generates activated carbon char entrained in the effluent gas, further comprising an activated carbon char collector to capture and remove activated carbon char from the effluent gas, further comprising pollution control equipment which contacts the effluent gas with said activated carbon char to capture and remove pollutants from the effluent gas.

45. (original) The gasifier according to claim 44, wherein the pollutants are selected from sulfur compounds, halogen compounds, and heavy metals.

46. (original) The gasifier according to claim 30, wherein the pulsating jets inject pressurized gas pulses.

47. (original) The gasifier according to claim 46, wherein the gas pulses comprise pulses of air, oxygen, steam, carbon dioxide, gaseous fuel, or recycled effluent gas.

48. (original) The gasifier according to claim 30, configured to simultaneously process coarse fuel in the fixed bed gasification section and fine fuel in the entrained flow gasification section.

49. (original) The gasifier according to claim 30, configured to operate using only coarse fuel in the fixed bed gasification section.

50. (original) The gasifier according to claim 30, wherein the upper plenum is configured to provide an effluent gas residence time and operating temperature sufficient to crack tars and oils contained within the effluent gas.

51. (original) A gasifier comprising:
a coarse fuel inlet;
a two-stage fixed bed gasification section that receives coarse fuel from the coarse fuel inlet, said fixed bed gasification section comprising:
an upper fixed bed section in which the coarse fuel is devolatilized to form volatilized gases which flow downward;
an internal cross-section constriction in the upper fixed bed section;
a lower fixed bed section; and
an upper plenum disposed adjacent the internal cross-section constriction;
a plurality of injection ports configured to introduce oxygen, steam, or air into different sections of the gasifier, wherein a portion of the ports are located adjacent the coarse fuel inlet; and
a gas effluent site from which gases obtained from the coarse fuel is discharged, wherein effluent gas from the fixed bed gasification section collect within the upper plenum and wherein the gas effluent site is located adjacent the upper plenum.

52. (original) The gasifier according to claim 51, wherein the upper plenum is configured to provide an effluent gas residence time and operating temperature sufficient to crack tars and oils contained within the effluent gas.

53. (currently amended) The gasifier according to claim 51, wherein the upper fixed bed section is configured to operate at a temperature which converts a portion of the coarse fuel into activated carbon char.

54. (currently amended) The gasifier according to claim 53, wherein activated carbon char is entrained with the effluent gas.

55. (currently amended) The gasifier according to claim 54, further comprising an activated carbon char collector to capture and remove activated carbon char entrained in the effluent gas.

56. (currently amended) The gasifier according to claim 53, further comprising an activated carbon char removal port to permit removal of activated carbon char from the fixed bed gasification section.

57. (currently amended) The gasifier according to claim 56, further comprising a screw device in combination with the activated carbon char removal port to permit removal of activated carbon char.

58. (currently amended) The gasifier according to claim 51, which generates activated carbon char entrained in the effluent gas, further comprising an activated carbon char collector to capture and remove activated carbon char from the effluent gas, further comprising pollution control equipment which contacts the effluent gas with said activated carbon char to capture and remove pollutants from the effluent gas.

59. (original) The gasifier according to claim 58, wherein the pollutants are selected from sulfur compounds, halogen compounds, and heavy metals.

60. (original) The gasifier according to claim 51, further comprising a plurality of injection ports configured to introduce oxygen, steam, or air into different regions of the gasifier.

61. (original) The gasifier according to claim 60, wherein the injection ports are configured to facilitate temperature control within the gasifier.

62. (original) The gasifier according to claim 60, wherein the injection ports are configured to control the steam to oxygen ratio within the gasifier.

63. (original) The gasifier according to claim 60, wherein the injection ports are configured to control the hydrogen to carbon monoxide ratio within the gasifier.

64. (original) The gasifier according to claim 60, wherein the injection ports are configured to control the amount of oxygen, steam, or air in different sections of the gasifier to promote a partial water gas shift reaction.

65. (original) The gasifier according to claim 64, wherein the injection ports are configured to control the amount of oxygen, steam, or air in different sections of the gasifier to control the temperature and to promote a methanation reaction.

67. (original) The gasifier according to claim 51, further comprising a plurality of pulsating jets disposed about the lower fixed bed section which agitate coarse fuel or ash within the fixed bed section.

68. (original) The gasifier according to claim 67, wherein the pulsating jets inject pressurized gas pulses.

69. (original) The gasifier according to claim 68, wherein the gas pulses comprise pulses of air, oxygen, steam, carbon dioxide, gaseous fuel, or recycled effluent gas.

70. (original) A method of gasifying a carbonaceous fuel feedstock comprising the steps of:

feeding coarse fuel into a gasifier having a two-stage fixed bed gasification section comprising:

an upper fixed bed section that receives the coarse fuel, wherein the upper fixed bed section operates at a temperature sufficient to devolatilize the coarse fuel and form volatilized gases which flow downward;

an internal cross-section constriction in the upper fixed bed section;
a lower fixed bed section; and

an upper plenum disposed adjacent said constricted cross-section;

introducing oxygen, steam, or air into the upper fixed bed section and lower fixed bed section control the temperature within the gasifier; and
withdrawing effluent gas from the gasifier.

71. (original) The method of gasifying carbonaceous fuel according to claim 70, wherein the amount of oxygen, steam, or air introduced into the fixed bed gasification section is varied to control the steam to oxygen ratio within the gasification chamber.

72. (original) The method of gasifying carbonaceous fuel according to claim 70, wherein the amount of oxygen, steam, or air introduced into the fixed bed gasification section is varied to control the hydrogen to carbon monoxide ratio within the gasifier.

73. (original) The method of gasifying carbonaceous fuel according to claim 70, wherein the amount of oxygen, steam, or air introduced into the fixed bed gasification section is varied to promote a partial water gas shift reaction.

74. (original) The method of gasifying carbonaceous fuel according to claim 73, wherein the amount of oxygen, steam, or air introduced into the fixed bed gasification section is varied to control the temperature and to promote a methanation reaction.

75. (original) The method of gasifying carbonaceous fuel according to claim 70, further comprising the step of feeding fine fuel into an entrained flow gasification section where the fine fuel is gasified.

76. (original) The method of gasifying carbonaceous fuel according to claim 75, wherein the entrained flow gasification section is disposed in a lower plenum adjacent the lower fixed bed section.

77. (original) The method of gasifying carbonaceous fuel according to claim 75, wherein fine fuel is fed into the entrained flow gasification section by at least one tangentially fired burner.

78. (original) The method of gasifying carbonaceous fuel according to claim 70, wherein effluent gas from the fixed bed gasification section collects within the upper plenum and wherein the effluent gas is withdrawn from the upper plenum.

79. (original) The method of gasifying carbonaceous fuel according to claim 78, further comprising the step of maintaining the effluent gas within the upper plenum for a sufficient gas residence time and operating temperature to crack tars and oils contained within the effluent gas.

80. (currently amended) The method of gasifying carbonaceous fuel according to claim 70, wherein the upper fixed bed section is operated at a temperature which converts a portion of the coarse fuel into activated carbon char.

81. (currently amended) The method of gasifying carbonaceous fuel according to claim 80, wherein activated carbon char is entrained with the effluent gas.

82. (currently amended) The method of gasifying carbonaceous fuel according to claim 81, further comprising the step of capturing and removing activated carbon char entrained in the effluent gas.

83. (currently amended) The method of gasifying carbonaceous fuel according to claim 80, further comprising the step of removing activated carbon char from the fixed bed gasification section.

84. (currently amended) The method of gasifying carbonaceous fuel according to claim 75, wherein a portion of the fine fuel is sized to ensure incomplete carbon combustion of the fine fuel which results in the generation of activated carbon char particles entrained with the effluent gas.

85. (currently amended) The method of gasifying carbonaceous fuel according to claim 84, further comprising the step of capturing and removing activated carbon char entrained in the effluent gas.

86. (currently amended) The method of gasifying carbonaceous fuel according to claim 70, further comprising the steps of:

generating activated carbon char;
capturing and removing activated carbon char from either the effluent gas or lower fixed bed section;

introducing activated carbon char and effluent gas into pollution control equipment wherein the activated carbon char contacts the effluent gas and captures and removes pollutants from the effluent gas.

87. (currently amended) The method of gasifying carbonaceous fuel according to claim 86, wherein the pollutants are selected from sulfur compounds, halogen compounds, and heavy metals.

88. (currently amended) The method of gasifying carbonaceous fuel according to claim 86, wherein the pollution control equipment comprises a baghouse.

89. (currently amended) A method of producing activated carbon char in a gasifier device comprising the steps of:

feeding coarse fuel into a gasifier having a fixed bed gasification section comprising:

an upper fixed bed section that receives the coarse fuel, wherein the upper fixed bed section operates at a temperature sufficient to devolatilize the coarse fuel and form volatilized gases which flow downward;

an internal cross-section constriction in the upper fixed bed section; and

a lower fixed bed section through which volatilized gases flow upward;

introducing oxygen, steam, or air into the upper fixed bed section and lower fixed bed section control the temperature within the gasifier, wherein the upper fixed bed section is operated at a temperature which converts a portion of the coarse fuel into activated carbon char.

90. (currently amended) The method of producing activated carbon char according to claim 89, further comprising the step of withdrawing effluent gas from the gasifier, wherein the activated carbon char is entrained with the effluent gas.

91. (currently amended) The method of producing activated carbon char according to claim 90, further comprising the step of capturing and removing activated carbon char entrained in the effluent gas.

92. (currently amended) The method of producing activated carbon char according to claim 89, further comprising the step of removing activated carbon char from the fixed bed gasification section.

93. (currently amended) The method of producing activated carbon char according to claim 89, further comprising the step of feeding fine fuel into an entrained flow gasification section where the fine fuel is gasified, wherein a portion of the fine fuel is sized to ensure incomplete carbon combustion of the fine fuel which results in the generation of activated carbon char particles entrained with the effluent gas.

94. (currently amended) The method of producing activated carbon char according to claim 93, further comprising the step of capturing and removing activated carbon char entrained in the effluent gas.

95. (currently amended) The method of producing activated carbon char according to claim 93, wherein the entrained flow gasification section is disposed in a lower plenum adjacent the lower fixed bed section.

96. (currently amended) A method for removing vapor phase pollutants from effluent gas produced by the gasification of carbonaceous fuel, wherein the gasification of carbonaceous fuel also produces activated carbon char as a byproduct, said method comprising the steps of:

supplying that activated carbon char sorbent to a baghouse having a filter bag therein until the filter bag is coated with a layer of sorbent; and

introducing the effluent gas into the baghouse, wherein a sufficient amount of activated carbon char sorbent is supplied to the baghouse to coat the filter bag and

facilitate intimate contact between the activated carbon char sorbent and vapor phase pollutants and thus removing vapor phase pollutants from the effluent gas.

97. (currently amended) A gasifier that produces activated carbon char comprising:
a coarse and fuel inlet port;
a fixed bed gasification section where coarse fuel is gasified and which is configured to operate at a temperature that devolatilizes coarse fuel to form volatilized gases, said fixed bed gasification section further comprising a carbon activation zone configured to operate at a temperature that destroys and cracks tars and oils remaining in the volatilized gases and coarse fuel, thereby converting the coarse fuel into activated carbon char;
a plurality of injection ports configured to introduce oxygen, steam, or air into different sections of the gasifier to control operating conditions within the gasifier; and
a gas effluent port where gases generated from coarse fuel are discharged.

98. (currently amended) The gasifier that produces activated carbon char according to claim 97, wherein the discharged gases comprise entrained activated carbon char and further comprising an activated carbon char collector to capture and remove activated carbon char entrained in the discharged gases.

99. (currently amended) The gasifier that produces activated carbon char according to claim 97, further comprising an activated carbon char removal port to permit removal of activated carbon char from the fixed bed gasification section.

100. (currently amended) A gasifier that produces activated carbon char comprising:
a fine fuel inlet port;
an entrained flow gasification section where fine fuel is gasified, wherein a portion of the fine fuel is sized to ensure incomplete carbon combustion of the fine fuel

which results in the generation of activated carbon char particles entrained with the effluent gas; and

a gas effluent port where gases generated from fine fuel are discharged, wherein the discharged gases comprise entrained activated carbon char.

101. (currently amended) A method for removing vapor phase pollutants from effluent gas produced by the gasification of carbonaceous fuel, wherein the gasification of carbonaceous fuel also produces activated carbon char as a byproduct, said method comprising the steps of:

supplying that activated carbon char sorbent to a gas filtration vessel having a filter media therein until the filter media is coated with a layer of sorbent; and
introducing the effluent gas into the gas filtration vessel, wherein a sufficient amount of activated carbon char sorbent is supplied to the gas filtration vessel to coat the filter media and facilitate intimate contact between the activated carbon char sorbent and vapor phase pollutants and thus removing vapor phase pollutants from the effluent gas.